Citation:

Storey KE, Hanning RM, Lambraki IA, Driezen P, Fraser SN, McCargar LJ. Determinants of diet quality among Canadian adolescents. *Can J Diet Pract Res.* 2009 Summer; 70 (2): 58-65.

PubMed ID: 19515268

Study Design:

Cross-sectional study

Class:

D - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To examine dietary intakes and nutrition behaviors among different diet quality groups of Canadian adolescents.

Inclusion Criteria:

Adolescents aged 14 to 17 years who were enrolled in Alberta and Ontario schools in grades 9 or 10.

Exclusion Criteria:

Students who:

- Did not complete the survey (N=31)
- Did not complete the 24-hour recall (N=35)
- Had extreme values of total caloric intake based on outlier analyses (N=14).

Description of Study Protocol:

Recruitment

Alberta and Ontario schools with grades 9 and 10 were selected according to a two-stage sampling technique.

Design

Cross-sectional study of 2,850 Alberta and Ontario adolescents aged 14 to 17 years, who completed a self-administered web-based survey that examined nutrient intakes and meal behaviors (meal frequency and meal consumption away from home).

Dietary Intake/Dietary Assessment Methodology

- *Dietary Intake:*
  - Weekday dietary intake was measured using a 24-hour dietary recall administered using the web-based food behavior questionnaire. Students reported all foods and beverages consumed the previous day by selecting from approximately 500 foods. A portion of the sample (N=150) completed 24-hour dietary recalls, which allowed nutrients to be adjusted for intra-individual variation to provide an estimate of usual intake
  - Diet quality was assessed using a food-based diet quality index that was modified to reflect CFGHE foods. Individuals consume foods, not individual nutrients, and therefore food-based diet quality indices provide information that can easily be used in health promotion. Further, food-based diet quality indices have been validated using the mean adequacy ratio, a measure of nutrient adequacy
  - Individuals were classified as having poor, average or superior diet quality according to the number of CFGHE food group recommendations met (poor = zero to one, average = two to three, superior = all four food groups)
  - Nutrient analysis was completed using ESHA Food Processor and 2001b Canadian Nutrient File database and compared with Dietary Reference Intakes for micronutrients considered key micronutrients for adolescents and generally found in high amounts in foods represented in the four food groups
- *Meal Behaviors:*
  - Questions were adapted for compatibility with web-based survey technology. Frequency of meal consumption was assessed by asking "How often do you usually eat breakfast/lunch/dinner/morning snacks/afternoon snacks/evening snacks?" Frequency of consuming meals away from home was assessed by asking, "How often do you eat meals or snacks prepared away from home?"
  - The following locations were assessed: School cafeteria, fast-food restaurants or take-out locations, other restaurants, vending machines, snack bars and convenience stores.

Statistical Analysis

- Software for Intake Distribution Estimation was used to produce estimates of usual intake and prevalence of micronutrient inadequacy expressed as the percentage below the Estimated Average Requirement
- Descriptive statistics, chi-square tests, T-tests and Mann-Whitney U tests were performed to analyze dietary intakes and intake differences between genders
- A 2 x 3 multivariate analysis of covariance (MANCOVA) was used to evaluate the association between gender and diet quality, where total caloric intake was the covariate
- Univariate follow-ups on significant MANCOVA results were completed on dependent variables
- The mean of morning, afternoon and evening snacks was used to assess overall frequency of snack consumption.

Data Collection Summary:

Timing of Measurements

- Anonymous survey took 30 to 40 minutes to complete during the school day
- Survey data collected between November 2002 and June 2003.

Dependent Variables

Diet quality: Poor, average or superior.

Independent Variables

- Dietary intakes
- Nutrition behaviors.

Description of Actual Data Sample:

- *Initial N:* 2,930
- *Attrition (final N):* 2,850
  - 1,233 boys, 1,596 girls
  - 762 from Alberta, 2,088 from Ontario
- *Age:* 14 to 17 years
- *Other relevant demographics:* Average age was 14.8 years
- *Location:* Alberta and Ontario, Canada.

Summary of Results:

Group Differences in Adjusted Nutrient Intakes, Based on Diet Quality

	Diet Quality				
Nutrients and Other Foods	**Poor**	**Average**	**Superior**	**F-value**	**P-value**
Nutrients (N=2,829)					
Carbohydrate	300.66± 2.36	295.36±1.54	298.78±5.07	1.81	NS
Protein	65.38±1.09	85.28±0.71	100.11±2.34	153.91	<0.001
Fat	83.31±0.90	76.64±0.59	68.66±1.94	31.62	<0.001
Fiber	13.56±0.32	14.85±0.21	16.98±0.69	11.87	≤0.001; 0.003
"Other foods" subcategories (servings per day) (N=2,829)					

Mostly sugar	0.62±0.04	0.53±0.03	0.39±0.09	3.07	0.022
High salt or fat	1.51±0.05	0.52±0.03	-0.10±0.11	154.70	<0.001
High-calorie beverages	1.67±0.06	0.85±0.04	0.42±0.13	79.29	≤0.001
Low-calorie beverages	1.18±0.09	1.25±0.06	1.70±0.19	3.30	0.011; 0.020
High sugar or fat	0.58±0.04	0.42±0.02	0.17±0.08	13.13	<0.001; 0.002

Group Difference in Meal Behaviors, Based on Diet Quality

	Diet Quality				
	Poor	**Average**	**Superior**	**F-value**	**P-value**
Meal frequency (N=2,038)					
Breakfast	3.89±0.06	4.13±0.05	4.38±0.17	6.85	0.002; 0.006
Lunch	4.46±0.05	4.59±0.03	4.68±0.12	3.41	0.017
Dinner	4.83±0.03	4.87±0.02	4.87±0.08	0.70	NS
Snacks	3.41±0.05	3.42±0.04	3.29±0.13	0.44	NS
Consuming meals and snacks away from home (N=2,417)					
School cafeteria	2.78±0.06	2.68±0.05	2.33±0.12	5.27	0.001; 0.004
Fast food or take out	2.70±0.04	2.48±0.03	2.18±0.07	18.41	<0.001
Other restaurants	2.16±0.03	2.04±0.03	1.96±0.07	4.12	0.011; 0.014
Vending machines	2.79±0.05	2.44±0.04	2.22±0.10	17.57	<0.001; 0.026
Snack bars	2.21±0.04	1.98±0.03	1.82±0.09	9.25	<0.001
Convenience stores	2.76±0.04	2.45±0.03	2.32±0.009	15.83	<0.001

Author Conclusion:

- Canadian adolescents have low intakes of Canada's Food Guide to Healthy Eating (CFGHE)-recommended foods and high intakes of "other foods"
- Those with poor diet quality had sub-optimal macronutrient intakes and increased meal skipping and meal consumption away from home
- Adherence to CFGHE may promote optimal dietary intakes and improve nutritional behaviors.

Reviewer Comments:

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions		
1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A

3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	Yes
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	N/A
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	N/A
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	No
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	N/A

6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	N/A
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	N/A
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	N/A
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes

8.7.	If negative findings, was a power calculation reported to address type 2 error?	No
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes